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A Farmers' Market at a Federally Qualified Health Center Improves Fruit and Vegetable Intake among Low-income Diabetics

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Abstract

Objective—A 22-week federally qualified health center (FQHC)-based farmers' market (FM) and personal financial incentive intervention designed to improve access to and consumption of fruits and vegetables (FV) among low-income diabetics in rural South Carolina was evaluated.

Methods—A mixed methods, one-group, repeated-measures design was used. Data were collected in 2011 before (May/June), during (August), and after (November) the intervention with 41 diabetes patients from the FQHC. FV consumption was assessed using a validated National Cancer Institute FV screener modified to include FV sold at the FM. Sales receipts were recorded for all FM transactions. A mixed-model, repeated measures analysis of variance was used to assess intervention effects on FV consumption. Predictors of changes in FV consumption were examined using logistic regression.

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Conflict of Interest Statement

The authors declare there are no conflicts of interest.

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Results—A marginally significant (p=0.07) average increase of 1.6 servings of total FV consumption per day occurred. The odds of achieving significant improvements in FV consumption increased for diabetics using financial incentives for payment at the FM (OR: 38.8, 95% CI: 3.4–449.6) and for those frequenting the FM more often (OR: 2.1, 95% CI: 1.1–4.0).

Conclusions—Results reveal a dose-response relationship between the intervention and FV improvements and emphasize the importance of addressing economic barriers to food access.

Keywords

Prevention & control; Community health centers; Health promotion; Diabetes Mellitus; Type 2; Obesity; Poverty

Introduction

Obesity rates in the United States are rising (Finkelstein et al., 2012; Flegal et al., 2010) resulting in increases in type 2 diabetes (Hu et al., 2001). Interventions designed to improve fruit and vegetable (FV) consumption are important strategies for preventing and treating obesity and diabetes (Ford et al., 2012; Gillies et al., 2007; Montonen et al., 2004; Yamaoka and Tango, 2005). Improving FV intake among Americans, however, has proven to be difficult (Grimm et al., 2010).

Recently, there has been a focus on increasing individual consumption of FV by improving access, availability, and affordability to FV in communities (Grimm et al., 2010). This focus emerged because populations disproportionately burdened by diet-related health conditions (Pan et al., 2009) are less likely to have healthy food retailers in their community (Dutko et al., 2012). Moreover, behaviorally-based interventions have not resulted in sustained improvements in diet (Jetter and Cassady, 2006).

Farmers' markets (FM) are targeted approaches for improving access to FV (Centers for Disease Control and Prevention, 2011). Primary health care settings such as federally qualified health centers (FQHC) provide an ideal context for establishing FMs because they are situated in underserved communities (Health Resources and Services Administration, 2012). Moreover, locating at a FQHC makes an explicit connection between FMs and preventive medicine.

Only a few studies reported have examined the influence of FM interventions on FV consumption; most have limitations related to study design and measurement of FV intake, are focused on the Women's Infant and Children (WIC) program participants, and are based in urban areas (McCormack at al., 2010). A recent review of the nutritional implications of FMs concluded "…there is limited research assessing the specific health benefits of farmers' markets" (McCormack et al., 2010).

Four FM interventions used repeated, validated measures to examine changes in FV intake (Abusabha et al., 2011; Anderson et al., 2001; Evans et al., 2012; Herman et al., 2008). Not one of these is focused on high-risk sub-populations like people with diabetes, conducted in a rural context, or conducted in a setting that serves medically underserved populations. In this analysis we addressed this gap by evaluating the influence of a FQHC-based FM and

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personal financial incentive intervention on FV consumption among low-income, diabetics in a rural context using validated measures of FV intake and objective measures of FM usage.

Methods

Design, Setting, and Participants

We used a community-based participatory research (CBPR) approach that involved a partnership between the University of South Carolina and Family Health Centers, Inc., an FQHC located in a majority minority (63% African American) rural county in South Carolina (U.S. Census Bureau, 2010). A one-group repeated-measures design was used. The study was approved by the university Institutional Review Board.

Adult participants were eligible if they were patients at the FQHC with a diabetes diagnosis as of March 1, 2011 (N=2,306 patients). Health center staff randomly selected 345 diabetics; each received a mailing that described the purpose of the study including information about the chance to receive $50 in vouchers to shop at the FM. Due to HIPAA, patient names and contact information were not revealed to the research staff; we are unable to track mailings that were undeliverable. It was impossible to determine the total sample that actually received an invitation to participate in the study. Interested potential participants were required to contact the research staff to express interest and determine eligibility. A total of 63 patients expressed interest; 9 could not be reached to schedule a survey, 9 were ineligible (e.g., no longer patient at FQHC, refused to consent). Our resulting analytic sample includes 45 diabetics. Informed consent was obtained from all participants; this involved verbal review of the written consent form to describe the purpose and process of the research prior to voluntary agreement to participate.

Intervention

The intervention was designed using community feedback, which is detailed in a documentary about the market (Murphy and Jacobs, 2011). We conducted a visioning exercise with 50 community members to understand their hopes for a new FM using a modified version of a nominal group process (Johnson et al., 2011). A 10-member Community Advisory Council was formed to guide the development of the FM including representatives from the FQHC, local schools/universities, agricultural extension, faith-based institutions, and community volunteers. Pre-market interest surveys were conducted with patients at the FQHC and local farmers.

Community feedback informed the two components of the FM intervention. First, onsite produce-only FMs operated at the FQHC once per week (10am–2pm) for 22 weeks from June-October 2011. The market was managed by a community member hired through grant funding. Supplemental Nutrition Assistance Program (SNAP) vouchers were accepted at the FM through a central point-of-purchase electronic benefits transfer system. Most of the vendors were certified to accept Senior and WIC Farmers' Market Nutrition Program Vouchers. Second, study participants were enrolled in a personal financial incentive program that provided up to $50 in vouchers to purchase FV at the FM. Vouchers were

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provided after participants completed two study-related surveys (described below) and were paid for through grant resources. Voucher usage at the FM was documented manually; in two instances a study participant exceeded the $50 maximum due to a recording error.

Instrumentation

We collected data with the diabetic patient sample at three time points: before the FM intervention (T1, May/June 2011), midway through the intervention (T2, August 2011), and immediately after the intervention (T3, November 2011). Data were collected via structured surveys either in-person or over the telephone by trained research assistants. Vouchers to shop at the FM were provided to participants after completing surveys at T1 and T2 ($25 each time). A stipend of $40 was provided after the third survey. A total of 45 participants completed the first survey and 44 completed the second and third.

The main outcome, assessed at each time point, was FV intake measured using a modified version of the 10-item NCI FV screener (Greene et al., 2008; Peterson et al., 2008; Thompson et al., 2002). The modified 19-item version included nine additional FV available at the FM (e.g., peach, apple, orange, cantaloupe, cabbage, broccoli, squash/zucchini, sweet potato, tomato). Demographics, social context, and health status information were collected at T1 using close-ended questions from the Behavioral Risk Factor Surveillance System survey (Table 1). We developed one question to assess self-reports of seven diet-related health conditions.

A receipt of each sales transaction (N=3,747) at the FQHC-based FM was recorded on an optically scannable form; 438 of the receipts were related to purchases made by the study participants. Receipts were recorded by trained research assistants and included the following information: date, participant ID, volume of produce purchased measured in units (e.g., 1 unit=1 peach or 1 basket of okra), cost of produce purchased, and form of payment.

Analysis

Descriptive statistics were computed to describe sociodemographic characteristics of participants, FM use, and food items purchased. FV consumption estimation followed NCI's guidelines (2010). Participants' reports of the frequency of intake and portion size of each food item were converted to average daily frequency and MyPyramid servings. Missing values for frequency of intake were considered as "never" for that food item. Missing values for portion size were imputed to individual's most frequently reported portion size for vegetable items or reported portion size of other fruit for fruit items. Daily frequency and servings were multiplied to generate average daily servings of single food items. Total FV consumption was calculated by summing all food items. Participants without surveys at T2 or T3 (n=1) and those reporting greater than three standard deviations above the mean (approximately 12.5 servings/day) at any time point (n=3) were excluded resulting in an analytic sample of 41 participants.

A mixed-model, repeated measures analysis of variance (ANOVA) was used to assess the effects of the FM and personal financial incentive intervention on FV consumption over time. The sample was dichotomized to explore factors associated with increases in FV consumption. "Increasers" were 56.1% of the sample whose average FV consumption at T2

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and T3 was at least 0.5 servings greater than their consumption at T1 whereas the "Non-Increaser" group constituted 43.9% of the sample that did not increase FV consumption over time. This level of change was selected because effective behavioral interventions typically improve diet by about 0.5 servings per day (Ammerman et al., 2002). Students' t-tests were used to compare FV consumption between the two groups at each time point. Logistic regression was conducted to examine potential predictors of changes in FV consumption. Self-reported height and weight were used to calculate body mass index [BMI=weight(kg)/height(m^2)]; continuous), payment type (study voucher only versus voucher+other form of payment), number of FM visits (continuous), total amount of money spent at the FM (continuous), and receipt of food assistance in the past year (yes/no) were included in the regression model. The goodness of fit of the regression model was adequate (χ^2=11.30, p=0.19), as assessed by the Hosmer and Lemeshow statistic. All statistical tests were performed using the SAS 9.2 (SAS Institute Inc., Cary, NC). The level of significance was set at $p < 0.05$.

Results

The diabetic sample was majority African American, female, and older (Table 1). Most participants were obese (BMI≥30kg/m^2) (World Health Organization, 2000) with an average BMI of 34.9±6.8 kg/m^2 calculated from self-reports of height and weight at T1. Participants had high rates of economic and food insecurity: most earned <$10,000 per year and 51.2% reported being at least somewhat worried about having enough money to buy nutritious meals during the past year. At T1, 75.6% had not shopped at a FM in the month before the FQHC-based FM opened.

All participants came to the FQHC-based FM on at least 2 dates throughout the 22-week season (average, 4.5 days; range, 2–15). On average, participants made 10.7 (range, 5–28) sales transactions at the FM with an average of 2.5 (range, 1–6) transactions per day indicating participants frequented multiple vendors at the market during their visit. In total, the 41 study participants made 438 sales transactions. The five most popular items purchased were peaches, sweet potatoes, squash/zucchini, corn, and tomatoes. Participants spent an average of $53.30 (range, $29–126) throughout the market season and an average of $5.49 during each sales transaction. Participants purchased food using multiple forms of payment often in the same sales transaction. Most participants (70.7%) paid for purchases with the study vouchers and at least one other form of payment (e.g., cash, SNAP) whereas 29.3% only used the study vouchers for payment.

Total FV intake increased from 5.9 servings per day at T1 to 7.5 and 6.5 servings per day at T2 and T3, respectively (Table 2). The increase of 1.6 servings per day in total FV consumption from T1 to T2 was marginally significant (p=0.07). FV intake at T3 was less than at T2, but was not statistically significant.

In the diabetic cohort at T1, we found that Increasers consumed fewer servings of FV per day compared to the Non-Increasers (T1: 4.9 vs. 7.3, p=0.02), whereas at T3 Increasers consumed significantly more FV servings per day compared to the Non-Increasers (T3: 7.8 vs. 4.8, p=0.01) (Table 3).

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The odds of being an Increaser in FV consumption were higher for diabetics who only used vouchers for payment at the market (OR: 38.8, 95% CI: 3.35–445.0) and for those who visited the FM more often (OR: 2.07, 95% CI: 1.09–3.95) (Table 4). Increasing FV intake was not associated with BMI at baseline, receipt of food assistance, or total amount of money spent at the FM.

Discussion

While FMs are beginning to open at a variety of health care delivery sites (Estabrook et al., 2012; George et al., 2011), this is the first FQHC-based FM intervention in the scientific literature. Findings highlight the benefit of a FQHC-based FM and personal financial incentive intervention designed to improve diet among diabetics. FV consumption increased by 1.6 servings per day from baseline to the mid-point (August) of the intervention and remained about half a serving higher than baseline after the market ended (November). Higher FV consumption patterns at the end of the FM intervention compared to baseline is noteworthy because FV consumption patterns tend to be higher in the summer compared to fall/winter months (Locke et al., 2009; Ziegler et al., 1987). Only a few studies have used repeated, validated measures to examine the influence of FMs on FV consumption (McCormack at al., 2010) finding improvements between 0.4 to 2.4 servings per day (Abusabha et al., 2011; Evans et al., 2012; Herman et al., 2008). The FQHC-based FM model contributed to increases in FV consumption at levels equivalent to or better than behaviorally-based interventions (Ammerman et al., 2002).

Results illuminate a dose-response relationship between the FM intervention and increases in FV consumption among the diabetic cohort. More frequent usage of the FM was associated with higher odds of increasing FV consumption. Findings also emphasize the importance of the personal financial incentive program. The relatively small financial incentive ($50) was quite beneficial to the diabetics. Those who only used the financial vouchers for payment at the FM were significantly more likely to increase FV consumption compared to those who used the voucher and at least one other form of payment. Findings suggest the FM and personal financial incentive intervention was particularly beneficial for those consuming the lowest levels FVs at baseline.

Strengths of this research include the use of a random sample, validated tools for measuring FV intake, and a repeated measures design. The context of the research is another strength; most FM research is focused on urban settings (McCormack et al., 2009) whereas this study occurred in a rural context. The sample is both a strength and limitation. The cohort of diabetics represents a population disparately affected by disease and hard-to-reach. The sample, however, may not be representative given its small size. The study design was enhanced by using a CBPR approach to engage community members in study development and implementation and by using mixed methods. Lack of a control group is a limitation. Future research is warranted that includes a larger sample and a more robust study design. Finally, there are limitations related to the sales transaction data collection process. There is a chance that some sales transactions made by the diabetic cohort were not recorded due to the busyness of the market; thus, findings may underrepresent FM utilization and benefit.

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Conclusion

Findings offer evidence for developing FMs at health centers as a strategy for improving patient health. FQHC-based FMs may be instrumental to providing preventive healthcare services to patient populations, particularly in contexts with high rates of diet-related health conditions or limited access to healthy food retailers (i.e., food deserts) or both. FQHC-based FMs have the potential to serve as a "farmacy" for patients to access nutrients fundamental to good health, especially if patients shop at the market on a regular basis. Personal financial incentives to improve economic access to FMs, similar to co-payment programs that facilitate patient access to pharmaceuticals, may further enhance the benefit of a FM intervention.

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Abbreviations

CBPR	community-based participatory research
FM	Farmers' market
FQHC	federally qualified health center
FV	Fruit and vegetable
HIPAA	Health Insurance Portability and Accountability Act of 1996
NCI	National Cancer Institute

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Highlights

- We evaluated a farmers' market and personal financial incentive intervention.
- The study occurred at a federally qualified health center in a rural context.
- Diabetics frequenting the market more often had greater improvements in diet.
- The financial incentive was critical to improving fruit and vegetable intake.

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Table 1

Characteristics of diabetics enrolled in the farmers' market intervention in rural South Carolina, June–October, 2011 (N=41).

Variables	Mean	Range
Age, years	63.6	34–88
Number of people living in household [a)]	2.1	1–8
Body mass index at baseline (T1) [b)]	34.9	24.2–51.6
Shopping days at farmers' market	4.5	2–15
Number of sales transactions at farmers' market	10.7	5–28
Amount of money spent at farmers' market, $	53.30	29.00–125.75
	Frequency	**Percent**
Gender		
Female	34	82.9
Race		
African American	38	92.7
White	3	7.3
Marital status		
Widowed	17	41.5
Married	10	24.4
Never married	9	22.0
Divorced or separated	5	12.2
Education level		
Less than high school	12	29.3
High school graduate or GED	18	43.9
Some college or technical school	6	14.6
College graduate or more	5	12.2
Annual household income (last year) [c)]		
Less than $10,000	22	53.7
$10,000 to $19,999	12	29.3
$20,000 to $29,999	5	12.2
Household food assistance (e.g., SNAP, WIC, and/or free or reduced price lunches)		
Yes	22	53.7
Household financial assistance (e.g., TANF, Medicaid, Disability, SSI)		
Yes	15	36.6
Primary form of transportation[c)]		
Personal vehicle	26	63.4
Ride with friend or family	11	26.8
Bus or taxi	3	7.3
Employment status[c)]		
Unable to work	18	43.9
Employed for wages	7	17.1

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Variables	Mean	Range
Retired	8	19.5
Out of work for 1 year or more	4	9.8
Not employed for wages (e.g., homemaker, student)	3	7.3
Worried about having enough money to buy nutritious meals in past year		
Always or usually	11	26.8
Sometimes	10	24.4
Rarely or never	20	48.8
Self-reported health status[c)]		
Excellent	1	2.4
Very good	1	2.4
Good	9	22.0
Fair	16	39.0
Poor	13	31.7
Self-reported disease status		
Diabetes	41	100.0
High Blood Pressure	37	90.2
Arthritis	33	80.5
Obesity	14	34.2
Heart Disease	13	31.7
Gallbladder	3	7.3
Cancer (ever)	2	4.9

[a)]Including the respondent;

[b)]Based on self-reports of height and weight at T1;

[c)]Totals do not add up to 100% due to missing data.

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Table 2

Fruit and vegetable consumption before (T1), during (T2), and after (T3) the federally qualified health center-based farmers' market intervention in rural South Carolina, June–October, 2011 (N=41).

	Time point[1]	Mean (Standard Deviation)	Mean Difference		95% Confidence Interval of the Difference		
					Lower	Upper	p-value for difference
Total fruit[2]	T1	3.23(2.41)	T2-T1	0.95	−0.20	2.09	0.10
	T2	4.18(3.06)	T3-T1	0.08	−1.07	1.23	0.89
	T3	3.31(2.29)	T3-T2	−0.87	−2.01	0.28	0.14
Total vegetable[3]	T1	2.70(1.44)	T2-T1	0.63	−0.24	1.50	0.16
	T2	3.33(2.29)	T3-T1	0.46	−0.41	1.34	0.29
	T3	3.17(2.11)	T3-T2	−0.16	−1.03	0.71	0.71
Total fruit & vegetable	T1	5.94(3.34)	T2-T1	1.58	−0.11	3.26	**0.07**
	T2	7.51(4.22)	T3-T1	0.54	−1.14	2.23	0.52
	T3	6.48(3.88)	T3-T2	−1.03	−2.71	0.65	0.23

[1] Time points include T1 (May/June 2011), T2 (August 2011), and T3 (November 2011).

[2] Fruit includes 100% juice, peach, apple, orange, cantaloupe, other fruits.

[3] Vegetable includes lettuce salad, cabbage, broccoli, squash or zucchini, sweet potatoes, French fries or fried potatoes, white potatoes, cooked dried beans, tomatoes, tomato sauce, vegetable soup, other vegetables.

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Table 3

Fruit and vegetable consumption among diabetics participating in a federally qualified health center-based farmers' market intervention in rural South Carolina, June–October, 2011 who did and did not increase consumption of fruits and vegetables over time.

Time point[2]	Non-Increaser[1] (n=18)	Increaser[1] (n=23)			
	Mean Fruit and Vegetable Consumption[3] (Standard Deviation)	Mean Fruit and Vegetable Consumption[3] (Standard Deviation)	Mean difference	95%Confidence Interval of the difference	p-value for difference
T1	7.28(3.45)	4.88(2.90)	2.40	0.39 – 4.40	**0.02**
T2	6.34(3.77)	8.43(4.40)	−2.09	−4.73 – 0.55	0.12
T3	4.80(2.30)	7.80(4.37)	−3.01	−5.16 – −0.85	**0.01**

[1] Increaser is defined as having average fruit and vegetable consumption at T2 and T3 that was at least 0.5 servings per day greater than consumption at T1. Non-increaser is defined as having average fruit and vegetable consumption at T2 and T3 less than 0.5 servings per day greater than consumption at T1.

[2] Time points include T1 (May/June 2011), T2 (August 2011), and T3 (November 2011).

[3] Expressed as servings per day

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Table 4

Odds ratios and 95% confidence intervals of increases in fruit and vegetable consumption over time among diabetics frequenting a FQHC-based farmers' market in rural South Carolina, June–October, 2011 (N=41).

Variables	Odds Ratio	95% Confidence Interval
Self-reported BMI	1.04	0.92–1.17
Payment type		
Study voucher only	**38.8****	3.35–445.0
Study voucher + other form of payment	1.00	Referent
Number of farmers' market visits	**2.07***	1.09–3.95
Total amount of money spent at the farmers' market	1.02	0.94–1.09
Receipt of food assistance in the past year		
Yes	0.39	0.07–2.08
No	1.00	Referent

* p<0.05

** p<0.01